

Air Toxics Organic Analysis Instrumentation - High Resolution Time of Flight Mass Spectrometer

Statement of Work

Draft

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Table of Contents

1.0 Overview and General Requirements

- 1.1 References
- 1.2 Background and Procurement Overview
- 1.3 General Description of the Air Toxics Organic Analysis Instrumentation
- 1.4 Safety, Health and Environmental Provisions
- 1.5 Electrical Requirements

2.0 Specifications

- 2.1 Time-of-Flight Mass Spectrometer
- 2.2 Time-of-Flight Mass Spectrometer Data System
- 2.3 Delivery and Training Requirements

3.0 Documentation Requirements

4.0 Acceptance Testing Requirements

5.0 Option Items

Appendices

Appendix A. Schedule of Deliverables

1.0 Overview and General Requirements

Contract deliverables and specific requirements are addressed in detail in subsequent sections of the Statement of Work.

1.1 References

All references shall be the most current available as of the date of this contract solicitation.

1.1.1 ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories

<http://www.iso.org/iso/en/CatalogueDetailPage.CatalogueDetail?CSNUMBER=30239>

1.1.2 NFPA 70, National Electrical Code (<http://www.nfpa.org>)

1.2 Background and Procurement Overview

1.2.1 As part of the Clean Air Act and its Amendments, a variety of new emissions regulations have been implemented for vehicles and engines. The EPA National Vehicle and Fuels Emissions Laboratory (NVFEL) has undertaken a comprehensive program to implement new and refined test systems to enhance the capabilities to conduct low level emissions testing, of the highest precision and accuracy, on a broad range of vehicles and engines.

1.2.2 In its role as a National Laboratory for the measurement of regulated emissions, and fuel quality, NVFEL plays a critical role in those measurements. To support that role, EPA seeks to purchase a high resolution liquid chromatograph - time of flight mass spectrometer as a significant part of its Air Toxics Organic Analysis Instrumentation (ATOAI) system.

1.2.3 For the equipment specified, the contractor shall have total system responsibility, which shall include all phases of the project, design/configuration, assembly, integration, quality assurance, delivery to EPA-NVFEL, installation, calibration, commissioning, acceptance testing, documentation and training of EPA staff. The contractor shall be responsible for documenting measurement traceability and system acceptance in a manner suitable for audit to ISO standards.

1.3 General Description of the Air Toxics Organic Analysis Instrumentation

1.3.1 The Air Toxics Organic Analysis Instrumentation shall include a high resolution, time-of-flight mass spectrometer system, with a liquid chromatograph, data system and interface(s) that meet the specifications stated in Sections 2.1 and 2.2.

1.3.2 It is necessary that the Data System of this instrument be easily networked with the existing Chem Lab network, which is currently running Windows NT, or Windows 2000 in the future.

1.4 Safety, Health and Environmental Provisions

1.4.1 Providing for a safe working environment is the highest priority in all EPA equipment purchases

and installation activity. The contractor shall abide and comply with any relevant building and safety codes specified by NEC, OSHA, and NFPA wherever they might apply, to create a safe system and work environment.

- 1.4.2 Significant risk factors such as noise, ventilation of toxic gases, heated surfaces, electrical shock, and safety interlocks to prevent accidental errors shall be evaluated by the contractor, and control measures to ensure the safety of operations and maintenance personnel shall be implemented by the contractor wherever feasible.
- 1.4.3 As required by OSHA, all equipment shall be designed to provide for straightforward lockout protection in accordance with OSHA regulations. Written lockout instructions, in hard copy and electronic formats, shall be provided by the contractor as part of the “as installed” documentation package.
- 1.4.4 Sound dampening/suppression devices and/or materials shall be installed as needed to limit noise levels to 60db at 10 feet from any devices delivered and installed under this contract.
- 1.4.5 The contractor shall consider energy efficiency in all component selection, system design and operational strategies. Energy efficient equipment, such as those with the “Energy Star” designation shall be utilized when possible.
- 1.4.6 The contractor shall strive for the minimization of the generation and release of harmful materials to the environment in all component selection, system design, and operational strategies and installation requirements of this contract. Requirements for venting of effluents must be clearly stated in the installation documentation. Toxic and Combustible monitoring equipment is not required.
- 1.4.7 The contractor shall provide the NVFEL Project Officer with a complete list of chemicals to be utilized during installation and commissioning operations at NVFEL, and their associated Material Safety Data Sheets (MSDS), at least four weeks prior to system installation.

1.5 Electrical Requirements

- 1.5.1 EPA will provide the following 3 types of power panels, as required, within 50 feet of the point of use. Motor and other noisy loads shall not be allowed on the clean power grid.

208 VAC/120 VAC, 1 phase, 60 Hz, utility grade power
480 VAC/277 VAC, 3 phase, 60 Hz, utility grade power
208 VAC/120 VAC, 1 phase, 60 Hz, clean power

The single phase 120 VAC is $\pm 5\%$, i.e., 114 to 126 VAC.

- 1.5.2 All equipment shall be installed in accordance with the most recent edition of NFPA 70, National

Electrical Code and required local codes.

- 1.5.3 Equipment design and installation shall permit operation in compliance with Occupational Safety & Health Administration (OSHA) Standards Part Number 1910. Electrical equipment shall comply with Part 1910 Subpart S.
- 1.5.4 Equipment design and installation shall be in compliance with the most recent edition of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.
- 1.5.5 Equipment design and installation shall provide energy-isolating devices required for equipment operators to follow the OSHA rule on the Control of Hazardous Energy (Lockout/Tagout) of Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147.
- 1.5.6 All electrical cables shall be isolated from gas lines.
- 1.5.7 All power receptacles shall be heavy duty, industrial grade.
- 1.5.8 Any clean/uninterruptible power outlets shall be clearly marked and in a color selected by the Project Officer.
- 1.5.9 Any clean/uninterruptible power outlets shall be isolated from utility grade power systems and installed in accordance with the principles of IEEE Std 1100.
- 1.5.10 Control and signal cables shall be isolated from power cables. All signal cabling shall not be adversely affected due to capacitive or inductive interference.
- 1.5.11 All Control and signal cables/wires shall be permanently labeled with to/from and signal/function name information that corresponds with the provided electrical schematic.
- 1.5.12 Digital I/O communications channels shall conform to recognized industry standards such as GPIB, IEEE 802, RS232, RS485, IEEE 488, IEEE 1394, or USB.
- 1.5.13 The contractor shall provide complete electrical schematics in its final documentation package.

2.0 Specifications

2.1 Time-of-Flight Mass Spectrometer

The time-of-flight (TOF) mass spectrometer shall include the following items:

- 2.1.1 An electrospray interface (ESI) ion source with dual sprays to operate in the lock mass mode at 2kV for both the positive and negative ion mode, the Ion Transmission Guide which keeps neutral ions out, up to 3MHz & 2500V focusing power, and an Ion Accelerator that operates at $\geq 7\text{kV}$ or is variable in that range.

- 2.1.2 A heated desolvating chamber that is continuously variable from 100°C to 300°C, a Reflectron Analyzer which has a path ≥ 2 m, and both a positive and negative ion detection unit.
- 2.1.3 An evacuation and control system with at least one turbomolecular pump, pump controller, and rough pump, all contained in the instrument cabinet.
- 2.1.4 A syringe pump for direct sample infusion.
- 2.1.5 A High Performance Liquid Chromatograph (HPLC). At a minimum, the HPLC shall include:
- (a) a quaternary pump system with seal wash and solvent selection, micro vacuum degassing capability,
 - (b) a thermostated column compartment w/column switching capability
 - (c) an autosampler and controller
 - (d) a system Control Module
 - (e) a Diode Array Detector with a high pressure micro flow cell
 - (f) an interface for the TOF PC to the HPLC for instrument control and data acquisition.
- 2.1.6 Additional ion sources. The additional ion sources shall include an Atmospheric Pressure Chemical Ionization (APCI) ion source and a Corona Discharge ESI ion source.
- 2.1.7 Accessories shall include a table for the Data System and a nitrogen (or helium) ballast tank for more stable interface operation.

The Basic Unit shall meet the following minimum performance standards:

- 2.1.8 A variable Scan speed that is ≥ 10 spectra / sec., with an ADC system to provide a linear dynamic range of at least 10^4 .
- 2.1.9 A resolution that is $\geq 6,000$ at FWHM of the peak, and a mass Range of 6 to $\geq 10,000$ m/z @ 7kV accelerating potential.
- 2.1.10 A sensitivity of S/N ≥ 10 , on a mass chromatogram of the protonated molecular ion of 10pG reserpine @ m/z609 in positive mode ESI, with the noise defined relative to RMS of the baseline and a flow rate of ~ 0.2 mL/min.

2.2 Time-of-Flight Mass Spectrometer Data System

The time-of-flight mass spectrometer data system shall include the following items:

- 2.2.1 The data system hardware shall have a configuration that is a 3.0 GHz, or faster PC with a P4 processor and has 512 kB cache, or more; 1 GB RAM or more; 80 GB hard disk, or greater; and 2 free slots, minimum.
- 2.2.2 The data system shall have the following disk drives, at a minimum:
- (A) a 1.44 MB floppy drive

(B) a DVD+RW drive

(C) a CD-RW drive.

For items (b) and (c) write capability as well as read is required, but not necessarily re-write capability.

2.2.3 A 19" flat panel color, or larger, monitor with True Color at a minimum of 1024 x 768 screen resolution.

2.2.4 An optical mouse & keyboard

2.2.5 An HP LaserJet color printer, or equivalent

2.2.6 A 10/100 BaseT ethernet interface

2.2.7 The data system computer shall have a completely installed Windows NT or 2000 operating system.

2.2.8 The full software suite for instrument control and data acquisition and management shall include the following programs/capabilities, at a minimum, as appropriate for the instrument system:

(A) Data Manager

(B) Adjustment Manager for real-time instrument tuning

(C) Display of instrument status, voltages, and pressures

(D) Measurement of spectrum

(E) Automatic mass calibration, mass drift correction, internal standard mass calibration, internal standard mass drift correction

(F) TIC and mass chromatogram display, processing history management, isotopic mass or atomic mass calculation

(G) Spectral de-convolution

(H) Quantitation data processing program

(I) Component detection algorithm software

(J) Library search program

The NIST/EPA/MSDC Mass Spectral Database and the Wiley Registry of Mass Spectral Database, and software for each, is required.

2.2.9 The contractor shall provide the operation manual for the data system. A CD-ROM version of the operation manual is acceptable.

2.3 Delivery and Training Requirements

2.3.1 The contractor shall be responsible for the shipping, delivery, installation, and proof of specs to NVFEL of all the equipment listed in Sections 2.1 and 2.2, as well as a minimum of one year parts and labor warranty on all items, including service travel costs.

- 2.3.2 The contractor shall provided all manuals and circuit diagrams for the time-of-flight (TOF) mass spectrometer.
- 2.3.3 The contractor shall provided a minimum of three (3) days of on-site operator training at the time of installation. This training is to be followed by a comprehensive operator training course at the manufacturer's facility.

3.0 Documentation Requirements

- 3.1 The contractor shall provide a complete "Lock-Out, Tag-Out" instruction for equipment requiring energy-isolating devices in accordance with the OSHA rule on the Control of Hazardous Energy (Lockout/Tagout) of Title 29 of the Code of Federal Regulations (29 CFR) Part 1910.147.
- 3.2 The contractor shall provide complete documentation of the quality control features of the delivered systems, and instructions as to their maintenance and utilization. This documentation shall be sufficient to provide system documentation and instruction to satisfy the relevant requirements of ISO 17025 - General Requirements for the Competence of Testing and Calibration Laboratories
- 3.3 The contractor shall supply a list of consumable items with recommended supply sources, as well as a recommended spare parts list for routine maintenance operations along with a list of those parts and recommended supply sources.

4.0 Acceptance Testing Requirements

- 4.1 The contractor shall develop a comprehensive final acceptance plan, approved by EPA, which will efficiently verify that all requirements contained in this Statement of Work, and referenced documents, have been achieved in the delivered system(s), and for compliance with specifications. This testing shall take place at NVFEL. The contractor shall provide all standards for this testing.
- 4.2 The contractor shall deliver a satisfactory acceptance plan to the EPA Project Officer at 30 days prior to the start of the acceptance process. Prior to commencement of acceptance testing, the EPA Project Officer must approve the acceptance plan, in writing. Once approved, the contractor shall provide the EPA Project Officer with a schedule of acceptance activities at least 7 days in advance.
- 4.3 The measurement performance of each analytical instrument shall be checked as part of the acceptance test process. Performance shall be demonstrated for each function of each instrument.

- 4.4 All computerized functions shall be tested as part of the acceptance process.
- 4.5 All acceptance testing shall be the responsibility of the contractor. The contractor, at the contractor's expense, shall rectify all non-compliant conditions. If repairs or changes are made, the contractor shall repeat acceptance testing to demonstrate the acceptable quality of the final product, to the extent necessitated by the scope of the repair or change. The contractor shall prepare a report for each phase of acceptance testing that clearly describes all the various tests and reviews conducted as part of the acceptance activity, the outcomes of those tests and a description of follow up actions, as required. Test reports shall be clearly cross referenced to the requirements of the Statement of Work and other significant performance details established during the technical interchange process.
- 4.6 EPA personnel shall observe the acceptance process. The EPA Project Officer may waive the opportunity to observe certain aspects of the acceptance process.
- 4.7 The acceptance plan shall be cross-referenced, section by section in a straightforward manner, to the requirements of this Statement of Work. The plan shall be designed in such a manner as to also form the basis of a final acceptance report. The acceptance plan shall also address all other requirements deemed significant and appropriate by the contractor, based on the specific design and configuration of their system and significant proprietary features.
- 4.8 Acceptance tests shall statistically demonstrate compliance with the parametric requirements of this Statement of Work within stated levels of uncertainty.
- 4.9 Acceptance tests shall also demonstrate that the system is computer virus free. Once delivered, EPA will scan the delivered computer systems and witnessed by the contractor before any connection is made to EPA computers or network systems. Virus scans shall also be conducted before and after any system updates using removable media are made on-site during the performance of work under this contract. Infected computers and/or media will be returned to the contractor for resolution. At its discretion, EPA virus scans may be waived for non-Windows systems.

5.0 Option Items

- 5.1 The contractor shall offer an option for an Extended Service Contract for the ATOI instrumentation, renewable every year for up to three (3) years from the date of acceptance plus one year for the initial warranty period.

Appendices

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Appendix A

Schedule of Deliverables

Dates shown are nominal completion deadlines relative to the contract award date or exercise option date. Where dates are not shown, the contractor shall propose appropriate dates at the Project Kickoff Meeting. All days are calendar days. All Technical Interchange Meetings (TIMs) are to be held at EPA-NVFEL. Video conferencing will be an acceptable alternative for some meetings. The contractor or EPA, as needed, may schedule TIMs.

Air Toxics Organic Analysis Instrumentation

Project Kickoff Meeting and Site Survey at EPA-NVFEL (30 days)

Begin Monthly Status Reports/Open Item Tracking Submission (Starting after project kickoff)

Submission of Proposed Acceptance Plan (90 days)

Proposed Acceptance Plan Review TIM

Submission of Final Acceptance Plan (105 days)

EPA Acceptance Plan Review (no more than 7 days after submission)

Submission of Calibration Reports and Measurement Traceability Documentation

Submission of Installation Material Safety Data Information to EPA for Approval

Equipment Delivery Date Confirmation to EPA (7 days in advance of shipment)

EPA-Provided Contractor Safety Training

Delivery of all equipment to EPA (180 days)

Equipment Installation (210 days)

Final Acceptance Testing Completed (270 days)

- Performance test must meet specs on each instrument and system

Training and Submission of all Documentation (300 days)

- Calibration, verification, and maintenance
- List of proprietary messages, if any
- Lock-out / Tag-out instructions
- Quality Control features
- List of Consumables

Final EPA Approval

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